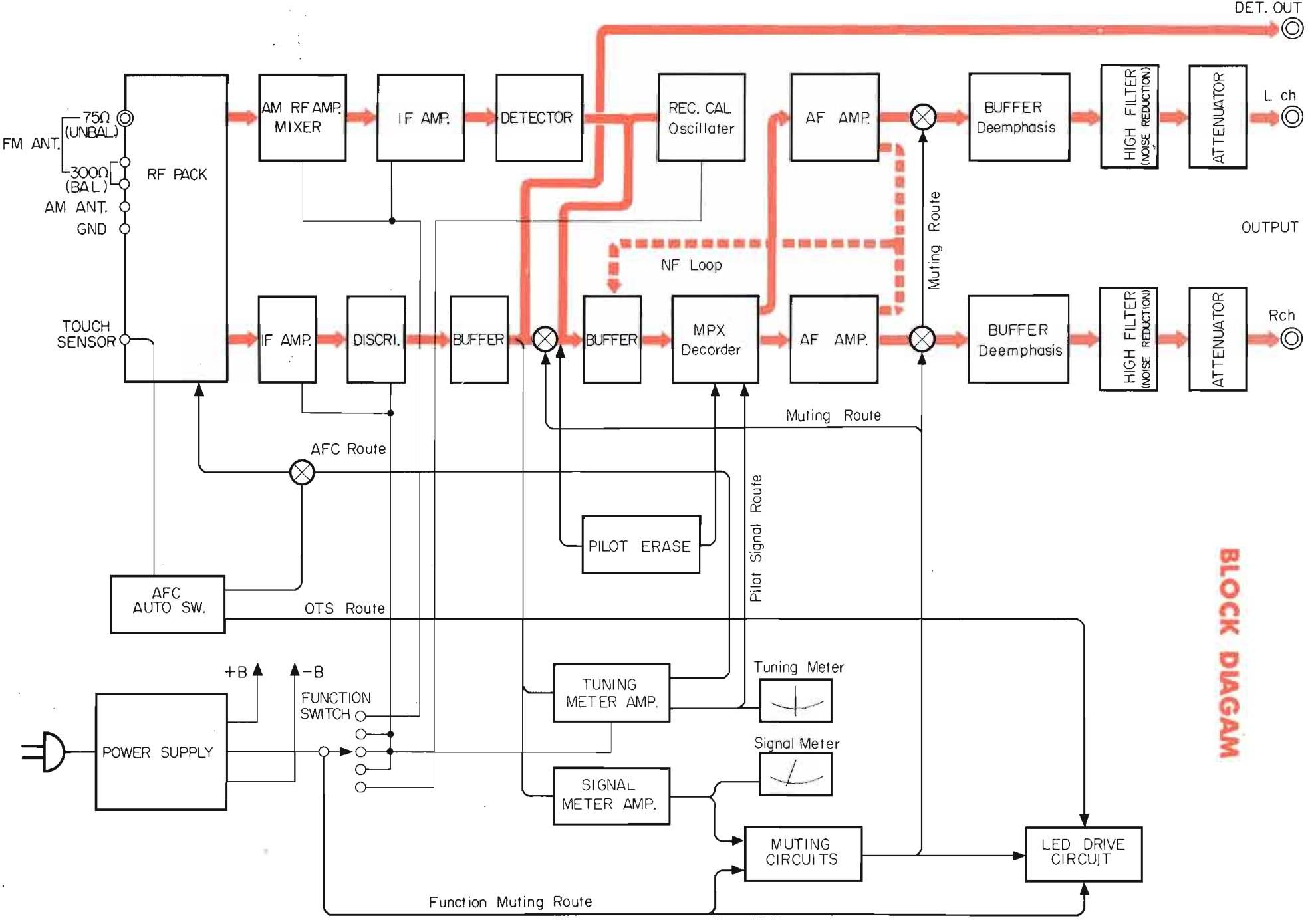

DET. OUT
FM ANT.
75Ω (UNBAL.)
300Ω (BAL.)
AM ANT.
GND
RF PACK
AM RF AMP. MIXER
IF AMP.
DETECTOR
REC. CAL Oscillater
AF AMP.
BUFFER Deemphasis
HIGH FILTER (NOISE REDUCTION)
ATTENUATOR
L ch
OUTPUT
NF Loop
Muting Route
TOUCH SENSOR
IF AMP.
DISCRI.
BUFFER
BUFFER
MPX Decorder
AF AMP.
BUFFER Deemphasis
HIGH FILTER (NOISE REDUCTION)
ATTENUATOR
Rch
Muting Route
AFC Route
PILOT ERASE
Pilot Signal Route
AFC AUTO SW.
OTS Route
+B
-B
FUNCTION SWITCH
POWER SUPPLY
TUNING METER AMP.
Tuning Meter
Signal Meter
SIGNAL METER AMP.
MUTING CIRCUITS
LED DRIVE CIRCUIT
Function Muting Route
BLOCK DIAGAM

FM FRONT END/IF

At the inlet, a double-tuning circuit is used. And a dual-gate MOS type FET is employed for high frequency amplification and mixing. This FET has high input impedance and small feedback capacity when compared with a transistor, which are suitable for high frequency amplification and mixing. Thanks to the double-tuning circuit and FET, outstanding selectivity, cross modulation characteristics, low noise and high gain can be obtained.

At the local oscillating section, IC is newly adopted for producing stable oscillating frequency and output voltage.

Intermediate frequency (IF) signal of 10.7MHz fed from the front end is transmitted to IC201 for IF amplification through VR201, and CFs 201 and 202. Output from No. 5 pin if further transmitted to IC202 amplitude limiter through CF203.

Generally, in the pass band of ceramic filter, undulation of characteristics occurs. This undulation causes deviation of phase of transfer frequency (FM modulated factor), resuting in phase distortion at detection output. To reduce such phase distortion, VR201 and T201 are added to the inlets of CF201 and CF202 respectively to match the impedance. This circuit is called "phase distortion compensating circuit."

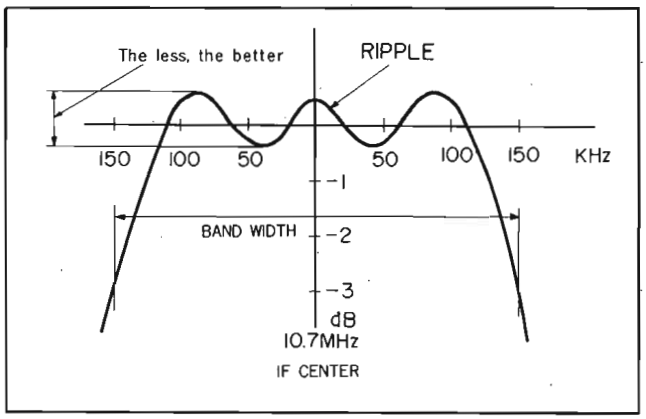


Fig. 1 **Band Pass Characteristics of Ceramic Filter**

AFC/TUNING METER CIRCUIT

IC203 amplifies DC element of discrimination output which TR203 and TR204 feed to No. 2 pin. This DC element becomes zero when central frequency of IF is 10.7MHz (perfect tuning) or when discrimination output is zero at perfect detuning. When IF shift from 10.7MHz, signal including DC element corresponding to shifting rate.

Part of amplified DC element is divided, and supplied to the varicap diode of RF pack as AFC control voltage in order to adjust the local oscillating frequency so that IF becomes 10.7MHz (now DC element is zero) at all times. At the same time, a pointer of tuning meter swings by this voltage. When DC element of discrimination output is zero, AFC voltage is also zero and the pointer of meter reads the center. When DC voltage is +, the pointer swings on + side, and when DC voltage is –, the pointer swings on – side.

SIGNAL METER CIRCUIT

FM

At detuning, discrimination output delivered from TR204 emitter contains noise signal with a wide band frequency spectrum from low to high frequency. This noise signal is transmitted to the base of TR220 through high-pass filters of C275, C276, C277, C279, L208 and L209, and then amplified at TR220 and TR219. The amplified signal is further rectified at D207, and separated – voltage is returned to the base of TR220 gets in OFF condition. In addition current does not flow from the emitter to the signal meter, so that the pointer of meter does not swing.

At tuning, amplified noise signal is small and voltage which is returned to the base of TR220 is low, so that TR is turned on. As a result, the current flows from the emitter and the pointer of meter swings.

Basic operation of TR217 and TR218 is similar to **that of TR220 and TR219, then sensitivity of meter is further graded up due to functions of two circuits.**

AM

When the voltage applied to D208 (7V of zenner diode) exceeds 7V, yielding current flows and pointer or meter swings. In other words, D208 detects the variation of collector voltage at TR229 as signal intensity, and transmits it to the meter.

AUTO-TOUCH TUNING CIRCUIT

In case of tuning when AFC actuates, AFC activates in the vicinity of tuning point, thus correct tuning point being hardly distingushed.

To avoid this trouble, it is necessary to turn off AFC when tuning is made. The auto-touch tuning circuit automatically does that.

When the tuning knob is touched with finger, noise factor catched by human being is amplified at TR215 and TR216, and then half-wave rectified. As a result, this noise factor emerges as + voltage. This + voltage turns TR201 on, and earthes AFC route leading to the RF pack. When the finger leaves the knob after tuning, noise factor to be amplified is eliminated, so that TR201 is turned off and earthing of AFC route is released.

MUTING CIRCUIT

Muting is to shut off the circuit to cut off noise as output produced while tuning from one station to another.

Muting of the machine is made by means of switching function of transistors. The muting system has 10 transistors – TR221, 224, 225, 226, 222, 223, 227, 202, 209 and 210. Of them TR227 actuates at the FUNCTION switch.

Switching transistors that shut down the signal directly are TR202, TR209 and TR210. When these transistors are forward biased (+B flows to the base of TR202 through R364), TR202 is turned on, and discrimination output from TR204 emitter is short-circuited. Similarly, when TR209 and TR210 are turned on, output system of MPX is short-circuited. At this time, muting function is in service. On the contrary, the bases of TR202, TR209 and TR210 are reversely biased, they are turned off and muting is inoperative. TR226 causes reverse bias. When TR226 is turned on, central potential of R301 and R302 becomes –, and – potential appears on the bases of TR202, TR209 and TR210 through the muting switch S2. When TR226 is turned off, – potential does not flow but +B flow, so that TR202, TR209 and TR210 become to be turned on. Fig. 2 and Fig. 3 show on/off conditions of TR226.

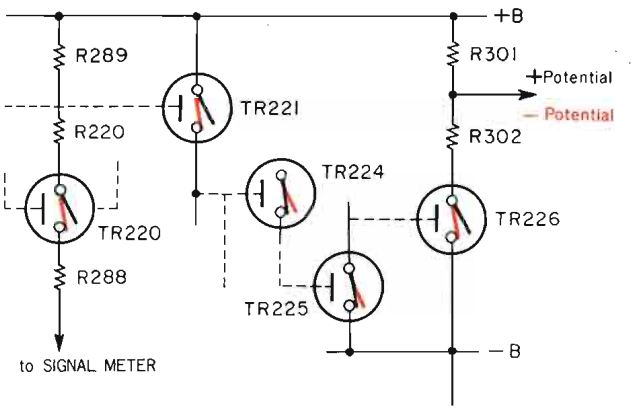


Fig. 2 Muting Action (1)

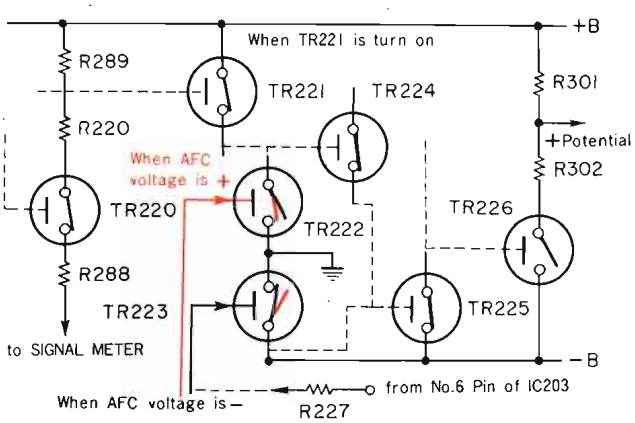


Fig. 3 Muting Action (2)

On/off actions of TR221 depend on the action of TR220 in the signal meter circuit.

At detuning, when TR220 is turned off, current does not flow through R290 connected to the collector of TR220. At this time, current does not flow through the base of TR221, causing off condition. When TR220 is turned on. TR221 is forward biased and turned on.

In other words, when TR220 is under off codition, TR221 is also off condition, and when TR202 is on, TR221 is on.

TR222 and TR223 serves to mute until almost tuning condition. In the vicinity of tuning point, noise factor is reduced and TR220 and TR221 are turned on (while TR224 and TR225 are turned off). Moreover, due to + and – of slight AFC voltage, TR222 or TR223 is turned on, causing muting condition. When AFC voltage is +, TR222 is turned on, and voltage of R294 appears. This voltage turn TR224 on. On the contrary, when AFC voltage is –, TR223 is turned on, and voltage of R296 appeas to turn TR225 on. After a series of actions mentioned above, TR226 is turned off, and muting function becomes activated. TR227 performs muting of the function system. When the FUNCTION switch Slb is already set at FM position, B-E potential of TR227 is almost same. At this time, condition is off, and muting is inoperative. When switch is turned, contact is released and base potential is drops, so that TR227 is turned on, +B is fed to the base of TR202, TR209 and TR210 through R303, causing muting. Thereby, noise whitch is caused when the switch is turned is eliminated.

When the muting switch S2a is under off condition, +B flows to the base of TR221 through S2a, and TR221 is turned off.

When the muting switch S2a is set at 30μV position, R341 is parallel-connected to R289, so that combined resistance value is reduced. Here, to turn TR221 on, it is required to increase current passing through the conbined resistance (that is, TR220). In other words, if signal is not so intensified, muting does not become inoperative. This is convenient for use in strong electric field.

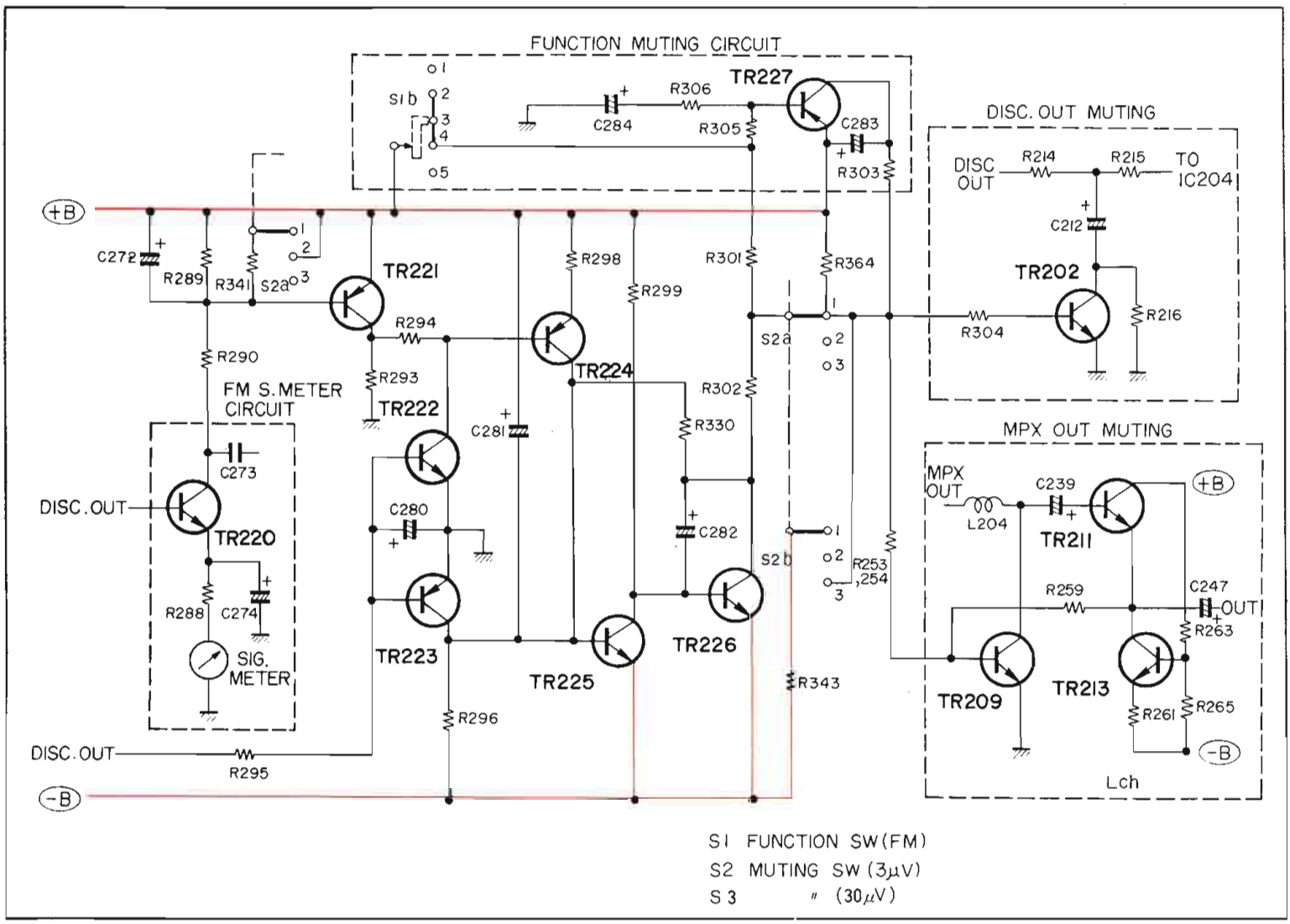


Fig. 4 Muting Circuits

MPX DECORDER CIRCUIT

The MPX circuit uses PLL type IC . No. 2 pin (input terminal) of IC204 receives composite signal from the emitter of TR204.

In addition, 19KHz pilot signal is independently supplied to No. 13 pin (phase comparator input terminal) from the meter output stage of IC203 through the high-pass circuit. Thereby, stability of PLL function is improved.

Oscillating frequency of VCO is controled and stabilized by phase-comparing 19KHz obtained at the VCO block of IC with pilot signal.

Stereo signals from No. 4 and No. 5 pins of IC204 are respectively amplified at TR207 and TR208 and then put out through the filter.

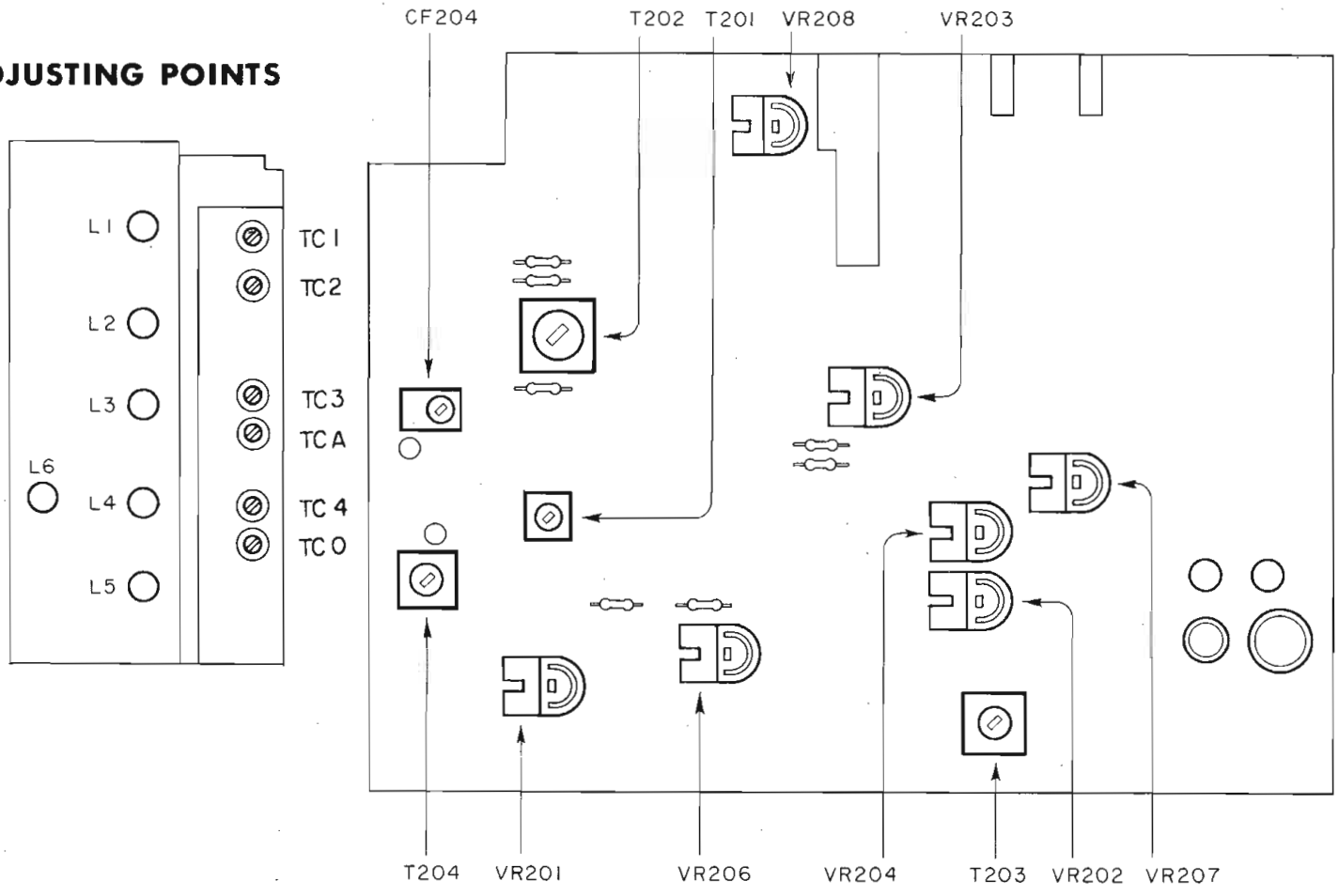
Part of the stereo signals is fed back to the input stage of IC204 from the emitter of TR207 and TR208.

Futhermore, operating point of the switching block of MPX is controlled with the variation of NF value in order to improve the separation performance. Pilot signal included in the composite which is fed to base of TR205 is not required because the comparator input is obtained from another system. Then, to erase the pilot signal the phase is reversed at TR228 by using 19KHz rectangular wave of VCO output, and the waveform is reshaped to the sine wave through the resonant circuit. After that this pilot signal is given to the composite signal as reversed-phase one.

ELECTRICAL ATTENUATOR CIRCUIT

When excessive signal is supplied to the high frequency amplifying stage to voltage-doubler detector, is fed back to the bases of TR229, TR230 and TR231 in order to controlled the base potential. Thereby, amplification of TR229, TR230 and TR231 is reduced, and occurance of distortion is decreased.

ADJUSTING POINTS



SEMI FIXED RESISTORS

VR201 . . . . . Phase Distortion Compensate
VR202 . . . . . Separation Adjusting
VR203 . . . . . VCO Free Run Frequency Adjusting
VR204 . . . . . Output Level Adjusting
VR206 . . . . . Signal Strength Meter Sensitivity
VR207 . . . . . Pilot Signal Erase Level Adjusting
VR208 . . . . . REC. CAL. Signal Level Adjusting

TRANSFORMERS

T201 . . . . . Phase Distortion Compensate
T202 . . . . . Discriminator Coil
T203 . . . . . 19KHz Resonant Coil

FM HIGH END TRACKING TRIMMER CAPACITORS

TC1 . . . . . Antenna Trimmer
TC2 . . . . . Antenna Trimmer
TC3 . . . . . RF Trimmer
TC4 . . . . . RF Trimmer

FM LOW END TRACKING ADJUST CORES

L1 . . . . . Antenna Coil Core
L2 . . . . . Antenna Coil Core
L3 . . . . . RF Coil Core
L4 . . . . . RF Coil Core
L5 . . . . . OSC Coil Core
L6 . . . . . IF Coil Core

AM HIGH END TRACKING TRIMMER CAPACITORS

TCA . . . . . High End Sensitivity
TCO . . . . . Local Oscillating Frequency Adjusting

AM LOW END TRACKING ADJUST CORES

T204 . . . . . OSC Coil Core
CF204 . . . . . Low End Sensitivity

ADJUSTING CIRCUIT BOARD

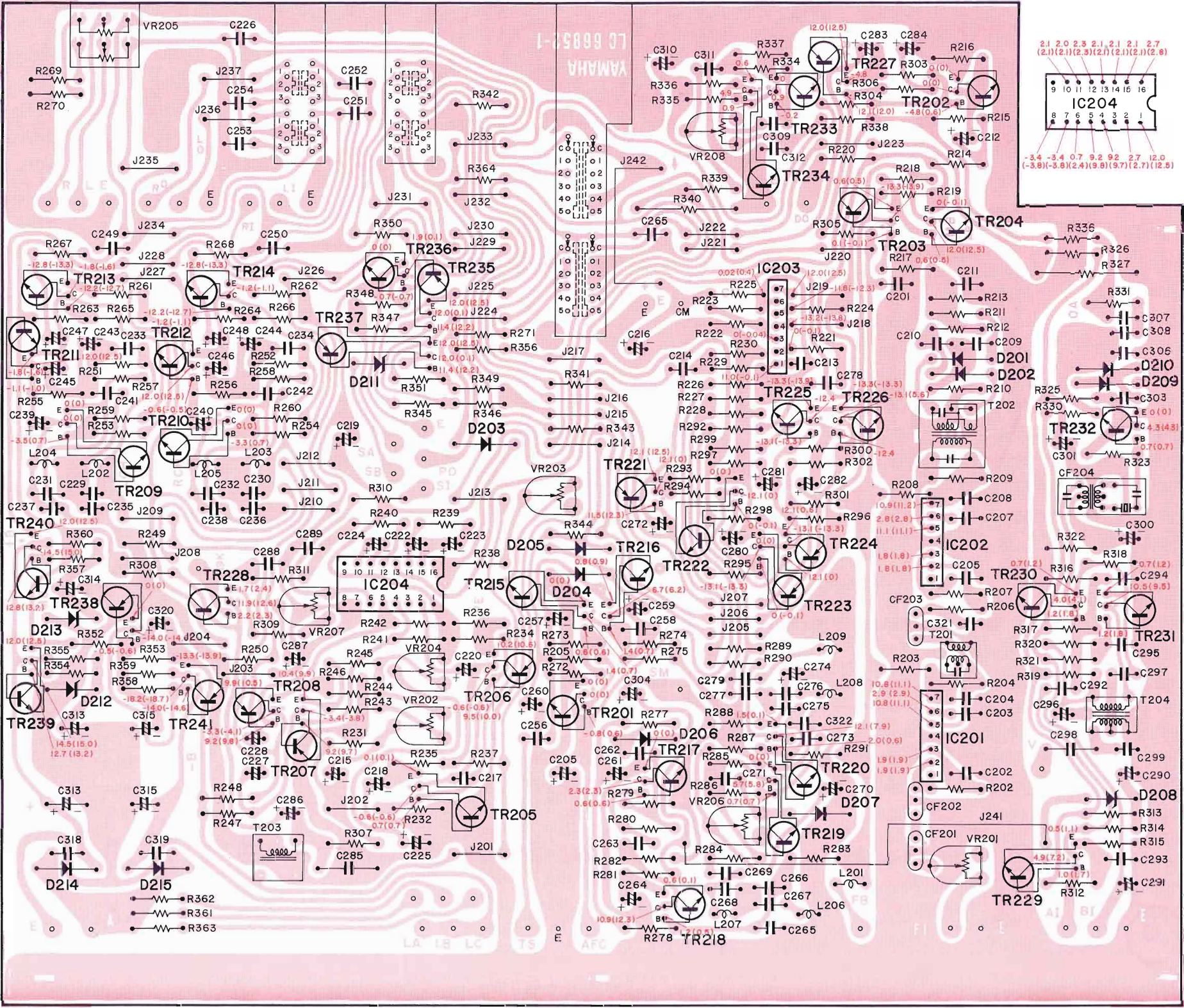
STEP	ITEMS	POINT	CONNECTING POINT		EQUIPMENT	METHODE	INDICATION
			INPUT	OUTPUT			
1	DISCRI. BALANCE	T202(S)			TUNING METER (built in)	Detuning point (98MHz) Turn the up-side core	0 (zero)
2	TUNING POINT SETTING	Tuning Knob	FM Ant.		FM SG 98MHz 60dBμ	Tune the knob so that TUNING METER read center.	
3	DISCRI. ADJUSTING	T202(P)	FM Ant.	Output Terminal(L)	FM SG –do– mono. 400Hz 100% OSC. VTVM Distortion Meter (DM)	Turn the bottom-side core so that distortion becomes minimum.	–60dB or less
4	VCO FREE RUN FREQUENCY	VR203	FM Ant.	19K Test Point	FM SG –do– Frequency Counter (FC.)	Adjust VR203 so that FC. reads 19KHz (confirm that FM SG is set to mono.)	19KHz±20Hz
5	PHASE DISTORTION	VR201 T201	FM Ant.	Output Terminal(L)	FM SG 98MHz 60dBμ stereo 400Hz 100% OSC. VTVM DM.	Turn VR201 and T201 so that distortion becomes minimum.	–58dB or less
6	PILOT SIGNAL ERASE	VR207 T203	FM Ant.	TR206 Emitter	FM SG 98MHz 60dBμ stereo pilot:9%	Connect VTVM and OSC to the emitter of TR206, and adjust VR-207 and T203 so that carrier level becomes minimum.	60dB or more (both ch.)
7	SEPARATION ADJUSTING	VR202 VR204	FM Ant.	Output Terminal	FM SG 98MHz 60dBμ stereo 400Hz 100% VTVM	Turn VR202 first so that output level of L and R are balanced. After that, turn VR204 so that separation becomes maximum.	50dB or more
8	SIGNAL METER SENSITIVITY	VR206	FM Ant.		FM SG 98MHz 80dBμ Mod:0% SIGNAL METER (built in)	Turn VR206 so that SIGNAL METER reads 90.	

ADJUSTING TRACKING ERROR OF FM SECTION

STEP	ITEMS	ADJUSTING POINT	CONNECTING POINT		METHODE	REMARKS
			INPUT	EQUIPMENT		
1	**POINTER OF DIAL CARIBRATION**	POINTER	FM Ant.	FM SG 98MHz 60dBμ	Tune the receiver to SG, then, loosen the pointer dial string, and set to 98MHz of the scale.	±1mm or less
2	**HIGH END TRACKING-ERROR CONFIRMATION**	Check only	FM Ant.	FM SG 108MHz 60dBμ	Tune the receiver to SG, then confirm that the pointer is on 108MHz of the scale.	±2mm or less
3	**TRACKING ERROR TRIMMING** (When proper confirm-ation cannot be made by step 2, proceed step 3)	Pointer	FM Ant.	FM SG 88 to 108MHz 60dBμ	Reset the pointer, so that error of reading becomes minimum in all range of the scale.	
4	**TRACKING ERROR TRIMMING** (When proper adjustment cannot be made by step 3, proceed step 4)	Pointer	FM Ant.	FM SG 98MHz 108MHz	Trim error by the pointer and L5 alternately. 98MHz – pointer of dial 108MHz – L5	
5	**HIGH END SENSITIVITY**	TC1, 2, 3, 4	FM Ant.	FM SG 108MHz	Turn TC1, 2, 3 and 4 so that SIGNAL METER swings maximum.	
6	**LOW END SENSITIVITY**	L1, 2, 3, 4	FM Ant.	FM SG 98MHz	Turn the cores of L1, 2, 3 and 4 so that SIGNAL METER swings maximum.	

ADJUSTING TRACKING ERROR OF AM SECTION

STEP	ITEMS	ADJUSTING POINT	CONNECTING POINT		METHODE	REMARKS
			INPUT	EQUIPMENT		
1	**LOCAL OSCILLATING COIL ADJUSTING**	T204	AM Ant.	AM SG 600KHz	Tune the pointer to 600KHz of the scale, then turn the core of T204, so that SIGNAL METER swings maximum.	
2	**LOW END SENSITIVITY**	Ant. Coil CF204	AM Ant.	AM SG 600KHz	Slide Ant. coil, and turn the core of CF204, so that SIGNAL METER swings maximum.	
3	**HIGH END TACKING ERROR TRIMMING**	TCO	AM Ant.	AM SG 1350KHz	Tune the pointer to 1350KHz on the saale, then turn TCO, so that SIGNAL METER swings maximum.	
4	**HIGH END SENSITIVITY**	TCA	AM Ant.	AM SG 1350KHz	Turn TCA and maximize SIGNAL METER.	


IC204
IC203
IC202
IC201
TR213
TR214
TR212
TR211
TR210
TR209
TR240
TR238
TR228
TR239
TR241
TR208
TR207
TR236
TR235
TR237
TR211
TR203
TR204
TR227
TR202
TR233
TR234
TR221
TR222
TR223
TR224
TR225
TR226
TR216
TR215
TR217
TR218
TR219
TR220
TR205
TR206
TR201
TR230
TR231
TR232
TR229
D201
D202
D203
D204
D205
D206
D207
D208
D209
D210
D211
D212
D213
D214
D215
T201
T202
T203
T204
CF201
CF202
CF203
CF204
VR201
VR202
VR203
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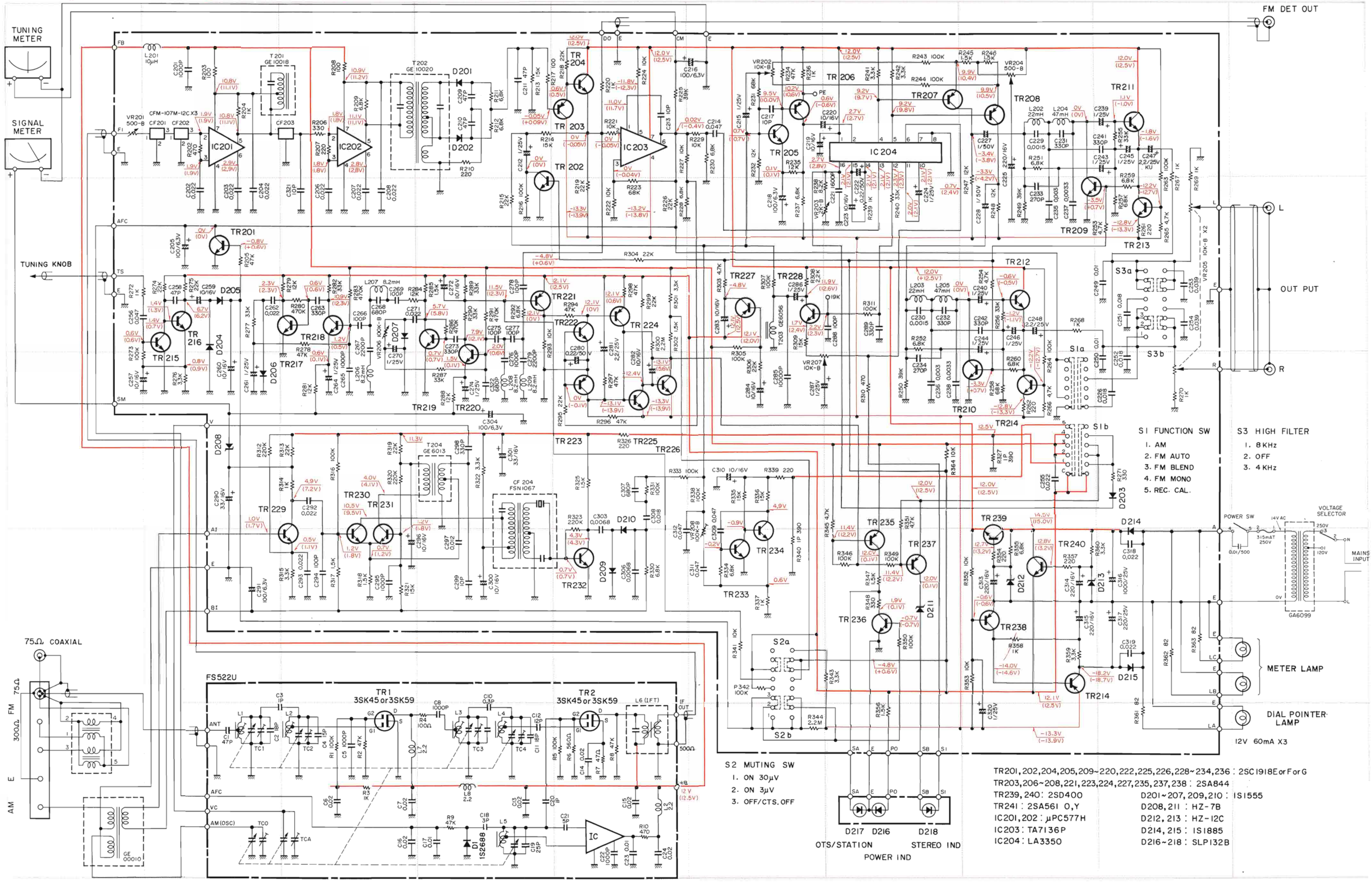
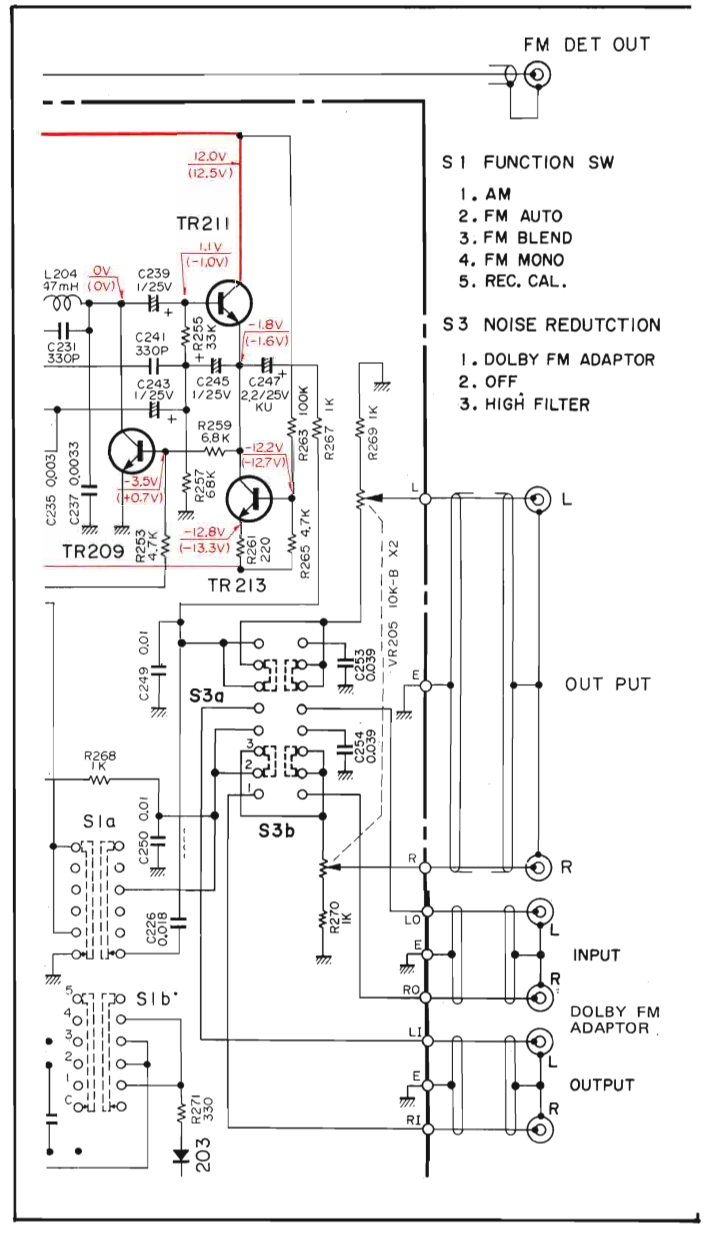
L203
L204
L205
L206
L207
L208
L209


TUNING METER
SIGNAL METER
TUNING KNOB
FM DET OUT
L
R
OUT PUT
S1 FUNCTION SW
1. AM
2. FM AUTO
3. FM BLEND
4. FM MONO
5. REC. CAL.
S3 HIGH FILTER
1. 8KHz
2. OFF
3. 4KHz
S2 MUTING SW
1. ON 30μV
2. ON 3μV
3. OFF/CTS. OFF
METER LAMP
DIAL POINTER LAMP
12V 60mA X3
75Ω COAXIAL
FS522U
TR1 3SK45 or 3SK59
TR2 3SK45 or 3SK59
IC201
IC202
IC203
IC204
IC
D217 D216 D218
OTS/STATION POWER IND
STEREO IND
POWER SW
VOLTAGE SELECTOR
MAINS INPUT
GA6099
TR201,202,204,205,209~220,222,225,226,228~234,236 : 2SC1918E or F or G
TR203,206~208,221,223,224,227,235,237,238 : 2SA844
TR239,240: 2SD400
TR241 : 2SA561 O,Y
IC201,202 : μPC577H
IC203 : TA7136P
IC204 : LA3350
D201~207,209,210 : 1S1555
D208,211 : HZ-7B
D212,213 : HZ-12C
D214,215 : 1S1885
D216~218 : SLP132B

DOLBY FM ADAPTOR CIRCUIT

U.S. & CANAKIAN MODEL

These models employ Dolby FM Adoptor so circuit diagram of output section is different from Basic Schematic Diagram as shown at right hand side.



VALUE OF ELEMENTS

The differential of value of resistors and capacitors used by export zone shows in the following table.

Models / Elements	BS., EUROPEAN, AUSTRALIAN	US., CANADIAN, GENERAL
C233, 234	270pF (Ceramic)	680pF (Ceramic)
C235, 236	0.003μF (Myler)	0.0047μF (Myler)
C237, 238	0.0033μF (Myler)	0.0047μF (Myler)
C249, 250	0.01μF (Myler)	0.011μF (Myler)
C251, 252	6.8KΩ (FCR25)	5.6KΩ (FCR25)
R267, 268	9KΩ (FCR25)	1.2KΩ (FCR25)

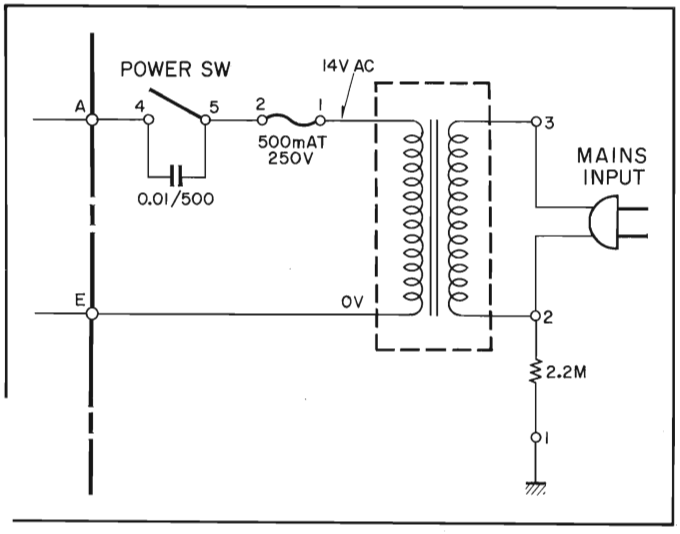
POWER SUPPLY CIRCUIT

The differential of Power Supply Circuits by export zone is shown in following figures.

US., CANADIAN & AUSTRALIAN MODELS

Used Transformer

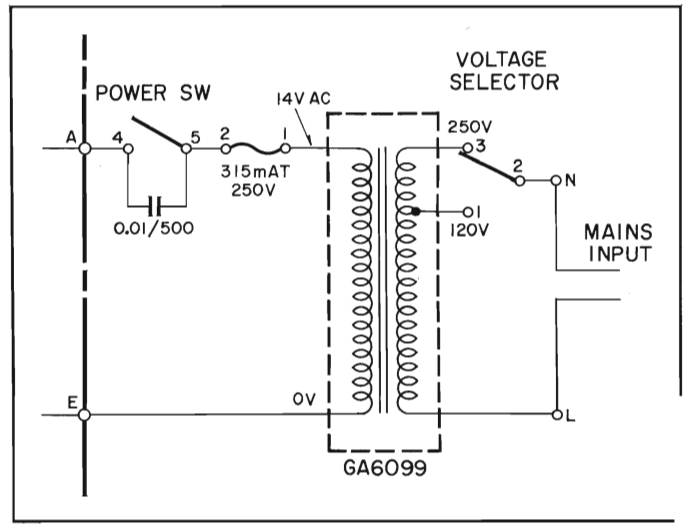
US., CANADIAN (120V–14V) GA60991
AUSTRALIAN (240V–14V) GA60992



GENERAL, BS. & EUROPEAN MODELS

Used Transformer

(110, 120, 130/220, 230, 240V–14V) GA60992



SPECIFICATION

FM TUNER SECTION

Tuning Range
88MHz to 108MHz
Usable Sensitivity (98MHz)
IHF mono. 1.9μV (300Ω) 10.8dBf
0.95μV (75Ω) 10.8dBf
DIN mono. 1.5μV (Dev: 40KHz, S/N: 26dB)
stereo 40μV (Dev: 40KHz, S/N: 26dB)
Sensitivity When S/N: 50dB
mono. 3.2μV 15.3dBf
stereo 40μV 37.2dBf
Signal-to-Noise Ratio
mono. 80dB
stereo 75dB
Image Frequency Rejection (98MHz)
110dB
IF Rejection (98MHz)
110dB
Spurious Response Rejection (98MHz)
110dB
AM Rejection
IHF 65dB
Capture Ratio
1.0dB
Effective Selectivity
85dB
Total High Harmonics Distortion
mono. 100Hz 0.07%
1KHz 0.07%
6KHz 0.15%
stereo 100Hz 0.09%
1KHz 0.07%
6KHz 0.15%
Cross Modulation Characteristics
IHF mono. 0.05%
stereo 0.1%
Stereo Separation
1KHz 52dB
50Hz to 10KHz 45dB
Frequency Response
50Hz to 10KHz ±0.3dB
30Hz to 15KHz $^{+0.3dB}_{-0.5dB}$
Sub Carrier Suppression
70dB
Muting Signal Level
3μV: 14.8dBf
30dB: 34.8dBf

AM TUNER SECTION

Circuit System
Resonant-less RF Amp. stage, differential convertor, superheterodyne.
Tuning Range
525KHz to 1605KHz
Usable Sensitivity
300μV/m (49dB/m)
Selectivity (1000KHz)
30dB
S/N Ratio (80dB/m)
50dB
Image Interference Ratio (1000KHz)
55dB
IF Interference Ratio (1000KHz)
40dB
Spurious Interference Ratio (1000KHz)
55dB
Total High Hamonics Distortion (80dB/m)
0.4%

AUDIO SECTION

Output Level/Impedance
FM 100% Mod. VRmin. to max. 0.1 to 1V/2.5KΩ, VR center 500mV/2.5KΩ
AM 30% Mod. VRmin. to max. 25mV to 250mV/2.5KΩ, VR center 125mV/2.5KΩ
REC. CAL VRmin. to max. 50mV to 500mV/2.5KΩ, VR center 250mV/2.5KΩ (Thus equivalent FM 50% Mod.)

CONTROLS

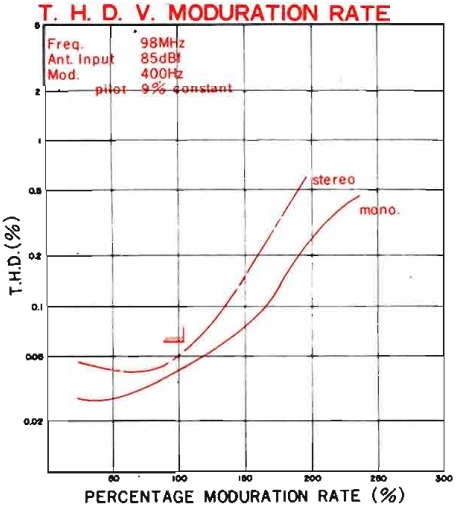
Muting Selector Switch
3μV/30μV/off
High Filter Switch (except U.S & CANADIAN models)
8KHz/off/4KHz
Noise Reduction Switch (U.S & CANDIAN models only)
Dolby FM adoptor/off/8KHz

GENERAL

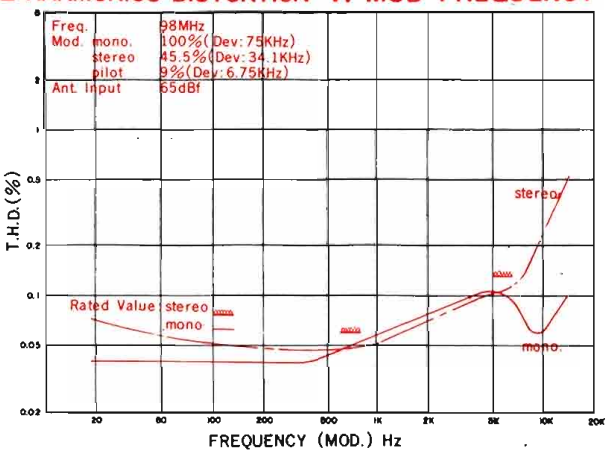
Semi Conductor Used
41 Transistors
5 ICs
2 FETs
12 Diodes, 3 Zenner diodes, 3 LEDs
Rated Voltage
120V 60Hz (U.S) 240V 50Hz (Australia)
110–130V/220–240V 50/60Hz (others)
Rated Power Consumption
8W
Dimensions
461(W) x 170(H) x 408(D)mm
18.3(W) x 6.7(H) x 16.1(D) in.
Weight
7.7Kg
17 lb

CHARACTERISTICS

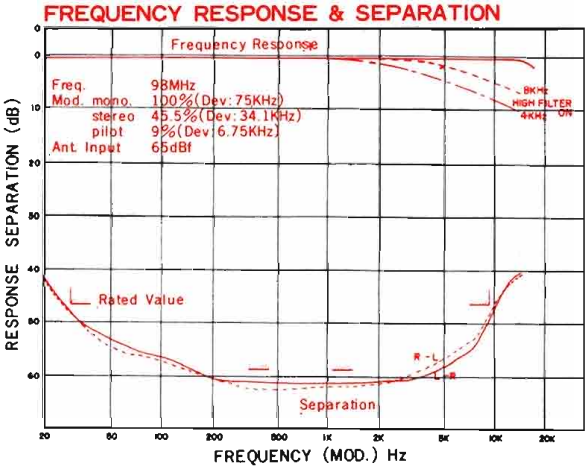
T. H. D. V. MODURATION RATE



TOTAL HARMONICS DISTORTION V. MOD FREQUENCY

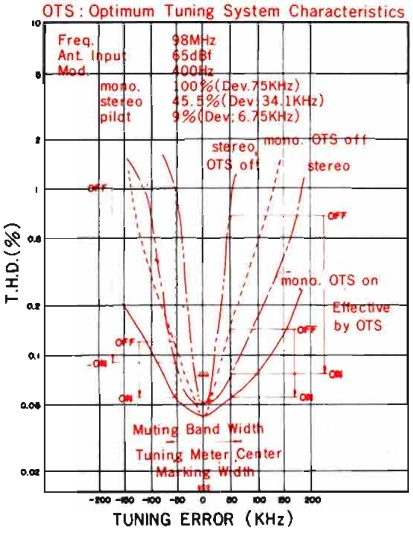


FREQUENCY RESPONSE & SEPARATION

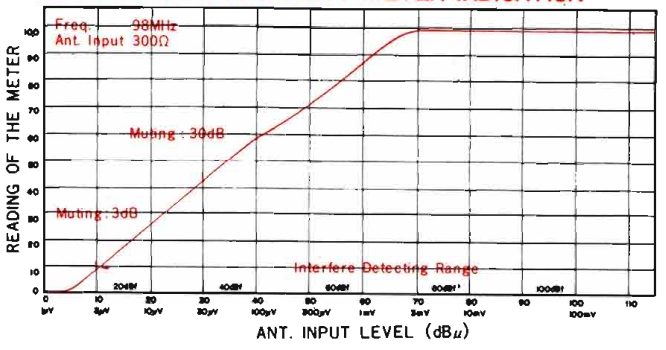


DISTORTION V. TUNING ERROR

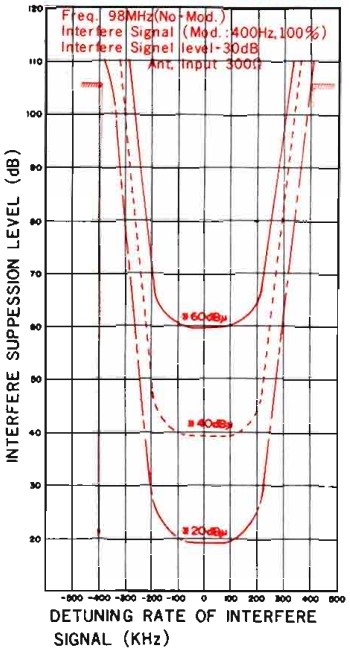
OTS : Optimum Tuning System Characteristics



SIGNAL STRENGH/QUALITY METER INDICATION



EFFECTIVE SELECTIVITY



OUTPUT SIGNAL & NOISE V. ANT. INPUT LEVEL